Choptank River Watershed Project

Health of the Chesapeake Bay Ecosystem

The Chesapeake Bay is the largest estuary in the United States and is a national treasure that has become increasingly endangered by pressures from human activity.

Agricultural and growing urban pressures on the Bay have led to the decline of this estuarine ecosystem.

An important indicator of ecosystem health is the dramatic decrease in shellfish populations.

States within the Chesapeake Bay Watershed have joined together efforts to restore health of the Bay with the establishment of the Chesapeake Bay Program.

What is CEAP?

The Conservation Effects Assessment Project (CEAP) began in 2003 as a multi-agency effort to quantify the environmental benefits of conservation practices used by private landowners participating in selected U.S. Department of Agriculture (USDA) conservation programs. Fourteen benchmark watershed studies managed by the Agricultural Research Service (ARS) were selected to complement the national assessment and to afford in-depth assessments of water, soil, and air quality and other benefits at a finer scale than is possible for the national assessment. Results from these studies will also provide a framework for evaluating and improving performance of national assessment models.

Choptank River Watershed Project Description
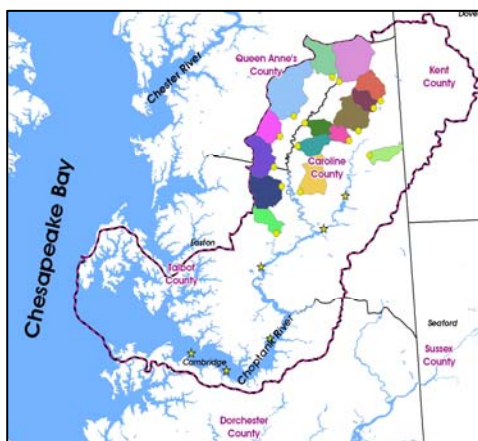
Choptank & Tuckahoe Rivers

The Choptank River is a major tributary of the Chesapeake Bay and is located on the Delmarva Peninsula. The 1756 square km (675 square mi) Choptank River Watershed is 58% agricultural (cropland and extensive poultry production), 33% forested, and only 9% urban. Portions of the Choptank River have been identified as "impaired waters" under Section 303(d) of the Federal Clean Water Act due to high levels of nutrients and sediments.

The Choptank River Watershed Project provides several unique aspects to the national CEAP effort. The river itself is tidal for much of its length and includes an ecologically delicate estuarine ecosystem. The soils in the region are poorly drained and the topography is especially flat; therefore, farmers have historically utilized a network of drainage ditches to facilitate the movement of water into streams. Urban influences are growing rapidly.

Project Goals

- Determine more accurate nutrient reduction efficiencies for the widely accepted agricultural Best Management Practices (BMPs) within the Choptank including riparian buffers, cover crops, and controlled drainage of ditches.
- Examine the changes in environmental services within the watershed as farmers increase participation in bioenergy production (e.g., hulless barley cover crop or harvesting biomass from buffers.)
- Develop innovative remote sensing approaches for assessing wetland ecosystem health and for estimating the BMP ability to improve water quality.
- Improve landscape decision support tools to optimize the effectiveness of BMPs.
- Foster positive relationships with farmers, stakeholders, and customers to preserve the natural resources of the Chesapeake Bay Watershed

Expected Outcomes

- *New strategies to exploit the synergies between bioenergy production and water quality protection that preserve agriculture on the Eastern Shore and preserve the fragile ecosystem of the Chesapeake Bay*
- *New landscape management tools to optimize implementation of agricultural BMPs within agricultural landscapes for water quality protection*
- *Efficient monitoring technologies for cover crops for program and watershed managers to optimize implementation of this important BMP at watershed and regional scales*
- *Improved management of the drainage ditches on the Eastern Shore to reduce export of nutrients from agricultural fields to the Bay*
- *New tools to measure and to assess health of wetland ecosystems within the agricultural landscape including wildlife habitat and water quality protection*

Landscape/Water Quality Modeling

Cost effective implementation of agricultural BMPs requires knowledge of how they function in different landscape settings within agricultural ecosystems. Water quality models play a vital role in evaluating the efficiencies of agricultural BMPs at landscape and watershed scales.

AnnAGNPS is a spatially explicit water quality model developed by USDA-ARS scientists. The model is a continuous-simulation and contains a substantial database of values for agricultural applications and management scenarios. It requires climate data, physical watershed parameters, as well as land use, soil and management data.

An initial and successful goal of the Choptank project has been calibration of the model for conditions of the Choptank watershed using the historic water quality data collected from the German Branch subbasin. Ultimately, the goal of this project is to apply the AnnAGNPS model to several other sub-watersheds and then to the entire Choptank watershed as a means to quantify the effects of cover crops, riparian buffers, and nutrient management on in-stream water quality in the presence of current and alternate farming practices.

For example, different scenarios of cover crop implementation can be evaluated for effectiveness of nitrogen load reduction based on model output. The calibrated AnnAGNPS model can also be used to develop a planning tool for BMP placement in landscapes.

A successful BMP implementation planning tool should allow the user to work at different scales of time and space in order to maximize nutrient load reductions while keeping costs to a minimum. The Choptank Watershed Project is working on development of a spatially explicit BMP planning tool that can be used by watershed managers.
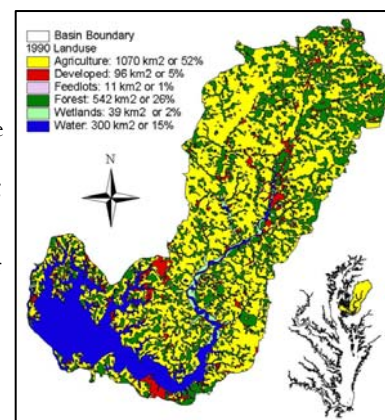
Use of Winter Cover Crops for Water Quality Protection

Winter Cover Crops are an important component of the suite of Best Management Practices being implemented within the watershed to improve water quality. The conventional cover crop program does not permit harvest of crop other than on-farm forage.

More flexible winter grain/cover crop production options are also needed to engage producers who wish to plant a winter crop. To address this need, in 2006 Maryland Department of Agriculture implemented a new state-wide commodities cover crop program that permits grain harvest in addition to the conventional cover crop program without harvest. A new commodity cover crop program permits growth of the crop for harvest but without fall fertilization. In this way the crop acts as a conventional winter cover crop for water quality protection.

Producers enrolled in a commodities cover crop program will be required to limit fertilizer application, reducing the overall nutrient load to the Choptank River while maintaining their grain yields.

Our research efforts are focusing on innovative technologies to measure and to quantify effectiveness of these various cover crop options.

Controlled Drainage

Many of the historic wetlands on the Eastern Shore have been drained by an extensive network of ditches. These ditches have a tendency to short circuit the landscape functions which can mitigate agricultural pollution of surface waters. Use of controlled drainage structures on ditches may restore some of this lost landscape function.

For example, these controlled flow structures can be highly effective mechanisms for reducing nitrogen in drainage ditches. In summer months with flash boards or risers in place, they effectively back up and hold water. This causes ditches to go anoxic and effectively reduce nitrate.

Current on-farm research within the Choptank River Watershed project focuses on the evaluation of the effectiveness of controlled drainage practices under real world conditions and management. This work will permit optimal implementation of this BMP on drainage ways in the Eastern Shore for improved Bay health.

Wetlands on the Choptank

Another exciting aspect of the Choptank Watershed project is a greatly expanded emphasis on wetlands research. We are working with the Natural Resources Conservation Service (NRCS) to design an intensive study in the Choptank River Watershed as part of a larger regional investigation. This study is designed to estimate the effects of conservation practices on ecosystem services provided by wetlands and associated lands in the Mid-Atlantic region. This new collaborative project brings together an interdisciplinary group of experts from multiple federal agencies (ARS, NRCS, and the U.S. Geological Survey) and the University of Maryland to assess the ability of "natural," restored, and prior-converted (drained) wetlands on cropland to improve water quality in the Choptank River and ultimately the Chesapeake Bay. It will not only leverage resources and expertise from multiple agencies; it will also synergistically combine information gained from individual wetlands with landscape scale measurements from satellite images. Project findings will be used to assess and improve the effectiveness of conservation practices and Farm Bill programs affecting wetlands and associated lands on the Maryland and Delaware Coastal Plain. Findings will also assist the Natural Resources Conservation Service in developing landscape monitoring tools and technologies for national wetlands conservation applications.

Bioenergy Production and the Chesapeake Bay

The Choptank River Watershed is an excellent test bed for innovative water quality protection strategies that incorporate bioenergy production. Maryland is implementing a unique hulless barley cover crop program with the goal of increased water quality protection.

Common barley has an abrasive hull that is hard on milling equipment and not an ideal feedstock for ethanol production. The hulless barley variety is easier to mill and contains more starch which is the substrate for ethanol production. Demonstrating the utility of a cover crop that both protects water quality and produces bioenergy provides a win-win scenario for conservation program implementation. This research will involve the innovative use of remote sensing technology to assess growth and nutrient uptake by potential bioenergy cover crops over the entire Choptank Watershed. Current research within the Choptank Watershed project evaluates both nutrient uptake and biomass production by winter cover crops. This work will also provide valuable information for assessment of the hulless barley initiative.

Other environmentally-friendly bioenergy opportunities exist within agricultural landscapes, such as the potential for environmentally responsible management and harvest of biomass produced in set-aside acreage (Conservation Reserve Program or CRP) and buffers which can protect soil and water quality and provide economic benefit to farmers. The rapidly-growing pressures for corn production associated with the manufacturing of ethanol will likely put negative pressures on the implementation of traditional conservation practices. Finding alternative economic ways of implementing water quality protection BMPs will be critical to Bay health and the preservation of agriculture on the Eastern Shore of Maryland.

There is a clear need for new landscape management tools to better implement the suite of agricultural BMPs necessary for both environmental and economic endpoints.

USDA
AGRICULTURAL RESEARCH SERVICE

For more information contact:

Dr. Greg McCarty
USDA-ARS
Beltsville, Maryland
Greg.McCarty@ars.usda.gov
301-504-7401
or
Dr. Laura McConnell
USDA-ARS
Beltsville, Maryland
Laura.McConnell@ars.usda.gov
301-504-6298

Current Partners

NRCS

University of Maryland 1856
*Horn Point Marine Lab &
Wye Research and Education Center*

Maryland Department of Agriculture

NOAA

Smithsonian Environmental Research Center

USDA Farm Service Agency

CRC

NASS

CSREES

Cooperative State Research, Education, and Extension Service
Research, Education, and Economics